

Water Quality Monitoring in Gray Creek
(Finley National Wildlife Refuge)

FW 410 Internship
July 20, 2000

Prepared for: U. S. Fish and Wildlife Service

Prepared by: April VanDatta
1455 NW Cumberland Ave.
Bend, OR 97701
Tel: 541-322-0348

Introduction

Gray Creek, located in Benton County, Oregon, supports the largest naturally occurring population of Oregon chub (*Oregonichthys crameri*) in the mid-Willamette basin. In 1993, the Oregon chub were determined to be of endangered species status and became protected under the Endangered Species Act.

The Oregon Department of Fish and Wildlife Aquatic Inventories project has been conducting surveys of the Oregon chub on Finley National Wildlife Refuge since 1991 and estimating population abundance since 1993. From 1993 through 1999 the population has remained stable. In 1995, dead fish were found for the first time in the minnow traps used for sampling. From 1996 to 1999, these occurrences became more wide spread. There were indications that the fish had died from low oxygen levels or contaminants (gills flared and mouths open). In the summer of 1999, the water in the creek had a deep orange color and oxygen levels were quite low. This was presumed to be a result of large inputs of spring water, which is typically high in iron and low in oxygen. In September 1999, it was determined that the orange color was a result of high levels of iron and iron bacteria.

Methods

I began working with Paul Scheerer of ODFW in the fall of 1999 to fulfill internship requirements for the Fisheries and Wildlife program at Oregon State University. I collected water quality data (temperature, pH, and dissolved oxygen), using a YSI Dissolved Oxygen meter and a pH meter, bi-monthly from October 1999 through May 2000. The meters were calibrated per manufacturers instructions, prior to each sampling trip. Three locations in Gray Creek were sampled. Site 1 was located near the permanent staff gauge upstream of the second large beaver pond on the refuge. Sites 2 and 3 were located approximately 250 and 500 meters upstream of Site 1. Following are the results of this eight-month internship.

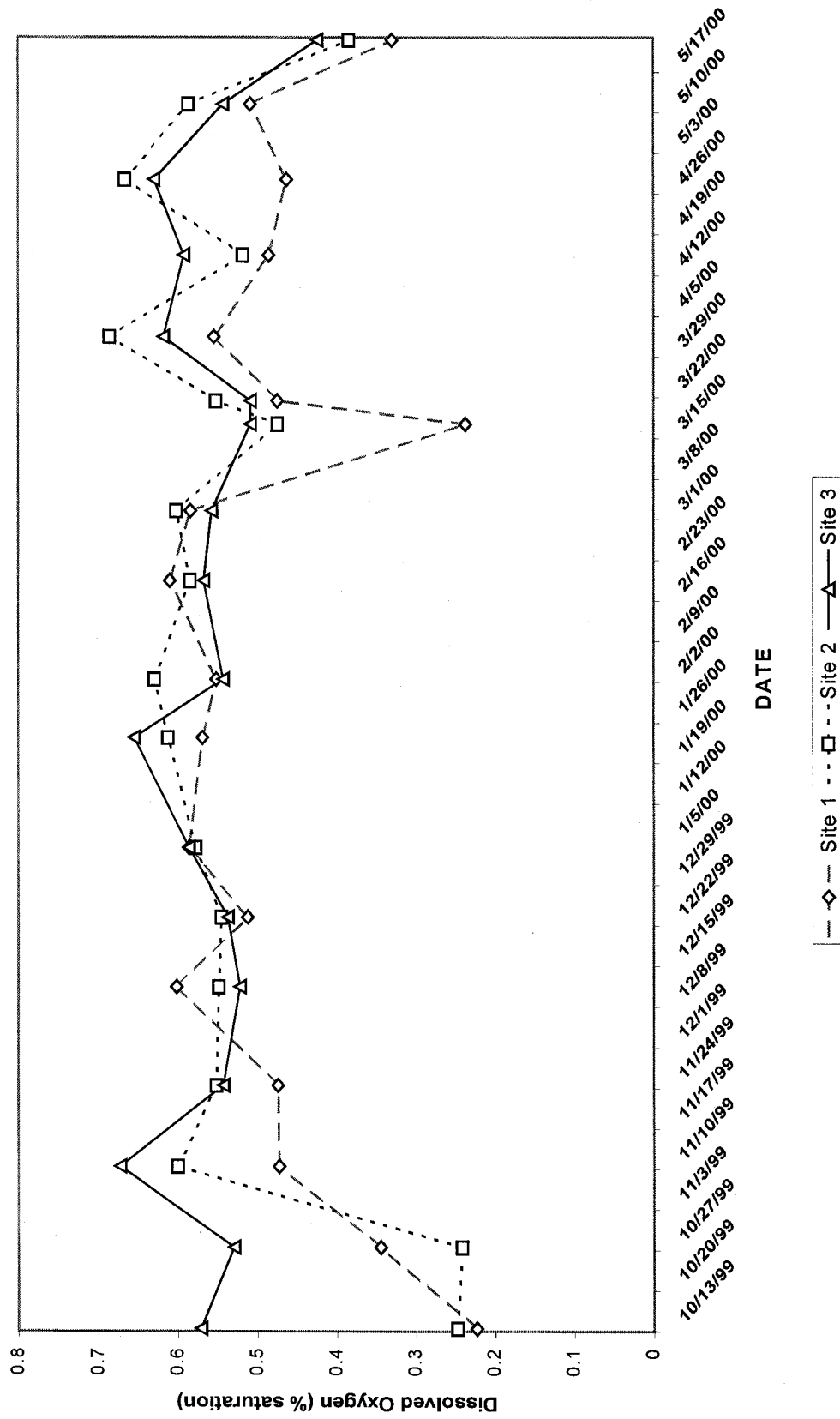
Table 1. Water quality measurements (temperature, pH, dissolved oxygen) from Gray Creek, Finley NWR.

Date		Site 1	Site 2	Site 3	weather/staff
10-13-99	temp	14.4	13.8	15.8	staff=1.35' sunny
	pH	6.9	7.1	7.2	
	DO	2.3	2.6	5.6	
	% sat.	22	25	57	
10-27-99	temp	9.0	8.1	8.0	staff=1.45' rainy
	pH	7.7	7.8	8.1	
	DO	4.0	2.9	6.3	
	%sat.	35	24	53	
11-10-99	temp	10.9	10.9	10.9	staff=2.60' rainy
	pH	7.1	7.8	8.1	
	DO	5.2	6.6	7.4	
	% sat.	47	60	67	
11-24-99	temp	9.4	9.3	9.4	staff=2.70' rainy
	pH	7.1	7.5	7.6	
	DO	5.5	6.4	6.3	
	% sat.	47	55	54	
12-9-99	temp	10.0	10.1	10.1	staff=2.80' rainy
	pH	7.3	7.4	7.3	
	DO	6.8	6.2	5.9	
	% sat.	60	55	52	
12-24-99	temp	7.3	7.1	7.2	staff=2.75' cloudy
	pH	7.3	7.5	7.4	
	DO	6.2	6.6	6.5	
	% sat.	51	55	54	
1-4-00	temp	8.5	8.5	8.5	staff=2.80' rainy
	pH	6.9	7.1	7.2	
	DO	6.8	6.7	6.8	
	% sat.	58	58	59	
1-21-00	temp	8.7	8.6	8.7	staff=2.80' rainy
	pH	7.3	7.1	7.8	
	DO	6.6	7.1	7.6	
	% sat.	57	61	66	
2-2-00	temp	9.3	9.2	9.1	staff=2.80' clear
	pH	7.1	7.3	7.2	
	DO	6.4	7.3	6.3	
	% sat.	55	63	54	
2-19-00	temp	8.0	8.0	8.3	staff=2.75' rainy
	pH	7.4	7.5	7.3	
	DO	7.2	6.9	6.7	
	% sat.	61	59	57	

Table 1 (continued).

Date		Site 1	Site 2	Site 3	weather/staff
3-2-00	temp	10.3	10.2	10.1	staff=2.75'
	pH	6.6	7.2	6.9	
	DO	6.6	6.8	6.3	
	% sat.	58	60	56	
3-17-00	temp	8.4	8.5	9.4	staff=2.70' rainy
	pH	7.1	7.4	7.4	
	DO	5.6	6.4	5.9	
	% sat.	24	47	51	
4-1-00	temp	15.1	13.0	11.2	staff=2.70' sunny
	pH	6.5	6.9	6.5	
	DO	5.6	7.2	6.8	
	% sat.	55	69	62	
4-14-00	temp	13.4	11.4	11.9	staff=2.75' clear
	pH	6.6	7.4	7.5	
	DO	5.1	5.7	6.4	
	% sat.	49	52	59	
4-28-00	temp	11.9	12.1	12.1	staff=2.75' showers
	pH	7.0	7.1	7.3	
	DO	5.0	7.2	6.8	
	% sat.	46	67	63	
5-11-00	temp	8.9	8.8	8.9	staff=2.80' showers
	pH	6.4	7.3	6.8	
	DO	5.9	6.8	6.3	
	% sat.	51	59	54	
5-22-00	temp	16.5	16.3	16.3	staff=2.80' sunny
	pH	7.4	7.4	7.2	
	DO	3.2	3.8	4.2	
	% sat.	33	38	42	

Dissolved Oxygen in Gray Creek, Finley NWR



Discussion

Concerns regarding water quality at Finley National Wildlife Refuge, and the potential negative impacts on endangered Oregon chub, prompted this study. In 1995, dead fish were found in minnow traps used to obtain population estimates. The dead fish were found with mouth agape and gills flared. The presence of dead fish in the traps was unique to this location. This continued to occur during population estimates in 1996-1999. In the summer of 1999, an orange precipitate was present in the water. Subsequent water quality measurements revealed high iron and iron bacteria in the water as well as low dissolved oxygen (~30% saturation).

Water temperature, water depth, dissolved oxygen, and pH were monitored from October 1999 through May 2000. The pH measurements varied little over the course of the study and between sample sites. Dissolved oxygen readings were commonly in the range of 45-65 percent saturation. The lowest levels occurred in October 1999, prior to the fall rains and again in the spring of 2000, when the weather cleared and temperatures warmed. Iron precipitate was observed only in October, prior to the fall rainy season, and on the margins of the beaver ponds in the spring. It is presumed that the orange precipitate is prevalent when overland stream flows drop and the contribution of spring water to the total water budget increases during the summer months. It is not uncommon for spring water to be high in iron and low in dissolved oxygen.

It is expected that lowest dissolved oxygen saturation levels occur during the late summer, and in the early morning hours (due to consumption of oxygen by aquatic macrophytes as they respire during the dark cycle of photosynthesis). Continued monitoring during the summer of 2000 is planned, including some 24 hour monitoring.